



## X-linked myotubular myopathy

X-linked myotubular myopathy is a condition that primarily affects muscles used for movement (skeletal muscles) and occurs almost exclusively in males. People with this condition have muscle weakness (myopathy) and decreased muscle tone (hypotonia) that are usually evident at birth.

The muscle problems in X-linked myotubular myopathy impair the development of motor skills such as sitting, standing, and walking. Affected infants may also have difficulties with feeding due to muscle weakness. Individuals with this condition often do not have the muscle strength to breathe on their own and must be supported with a machine to help them breathe (mechanical ventilation). Some affected individuals need breathing assistance only periodically, typically during sleep, while others require it continuously. People with X-linked myotubular myopathy may also have weakness in the muscles that control eye movement (ophthalmoplegia), weakness in other muscles of the face, and absent reflexes (areflexia).

In X-linked myotubular myopathy, muscle weakness often disrupts normal bone development and can lead to fragile bones, an abnormal curvature of the spine (scoliosis), and joint deformities (contractures) of the hips and knees. People with X-linked myotubular myopathy may have a large head with a narrow and elongated face and a high, arched roof of the mouth (palate). They may also have liver disease, recurrent ear and respiratory infections, or seizures.

Because of their severe breathing problems, individuals with X-linked myotubular myopathy usually survive only into early childhood; however, some people with this condition have lived into adulthood.

X-linked myotubular myopathy is a member of a group of disorders called centronuclear myopathies. In centronuclear myopathies, the nucleus is found at the center of many rod-shaped muscle cells instead of at either end, where it is normally located.

### Frequency

The incidence of X-linked myotubular myopathy is estimated to be 1 in 50,000 newborn males worldwide.

### Genetic Changes

Mutations in the *MTM1* gene cause X-linked myotubular myopathy. The *MTM1* gene provides instructions for producing an enzyme called myotubularin. Myotubularin is thought to be involved in the development and maintenance of muscle cells.

*MTM1* gene mutations probably disrupt myotubularin's role in muscle cell development and maintenance, causing muscle weakness and other signs and symptoms of X-linked myotubular myopathy.

## **Inheritance Pattern**

X-linked myotubular myopathy is inherited in an X-linked recessive pattern. The gene associated with this condition is located on the X chromosome, which is one of the two sex chromosomes. In males (who have only one X chromosome), one altered copy of the gene in each cell is sufficient to cause the condition. In females (who have two X chromosomes), a mutation must be present in both copies of the gene to cause the disorder. Because it is unlikely that females will have two altered copies of this gene, males are affected by X-linked recessive disorders much more frequently than females. A characteristic of X-linked inheritance is that fathers cannot pass X-linked traits to their sons.

In X-linked myotubular myopathy, the affected male inherits one altered copy from his mother in 80 to 90 percent of cases. In the remaining 10 to 20 percent of cases, the disorder results from a new mutation in the gene that occurs during the formation of a parent's reproductive cells (eggs or sperm) or in early embryonic development. Females with one altered copy of the *MTM1* gene generally do not experience signs and symptoms of the disorder. In rare cases, however, females who have one altered copy of the *MTM1* gene experience some mild muscle weakness.

## **Other Names for This Condition**

- CNM
- MTMX
- X-linked centronuclear myopathy
- XLMTM
- XMTM

## **Diagnosis & Management**

### Genetic Testing

- Genetic Testing Registry: Severe X-linked myotubular myopathy  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C0410203/>

### Other Diagnosis and Management Resources

- GeneReview: X-Linked Centronuclear Myopathy  
<https://www.ncbi.nlm.nih.gov/books/NBK1432>

### General Information from MedlinePlus

- Diagnostic Tests  
<https://medlineplus.gov/diagnostictests.html>
- Drug Therapy  
<https://medlineplus.gov/drugtherapy.html>
- Genetic Counseling  
<https://medlineplus.gov/geneticcounseling.html>
- Palliative Care  
<https://medlineplus.gov/palliativecare.html>
- Surgery and Rehabilitation  
<https://medlineplus.gov/surgeryandrehabilitation.html>

### **Additional Information & Resources**

#### MedlinePlus

- Health Topic: Muscle Disorders  
<https://medlineplus.gov/muscledisorders.html>

#### Genetic and Rare Diseases Information Center

- X-linked myotubular myopathy  
<https://rarediseases.info.nih.gov/diseases/11925/x-linked-myotubular-myopathy>

#### Educational Resources

- CLIMB: Myotubular Myopathy Info Sheet  
<http://www.climb.org.uk/IMD/Mike/Myotubular%20Myopathy.pdf>
- Disease InfoSearch: Severe x-linked myotubular myopathy  
<http://www.diseaseinfosearch.org/Severe+x-linked+myotubular+myopathy/9289>
- Joshua Frase Foundation: Family Guide to Myotubular Myopathy  
<http://www.joshuafrase.org/uploads/MTM%20family%20guide%20final%2012-19-14.pdf>
- Orphanet: X-linked centronuclear myopathy  
[http://www.orpha.net/consor/cgi-bin/OC\\_Exp.php?Lng=EN&Expert=596](http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=596)
- Washington University, St. Louis: Neuromuscular Disease Center  
<http://neuromuscular.wustl.edu/syncm.html#cnm>

### Patient Support and Advocacy Resources

- Joshua Frase Foundation  
<http://www.joshuafrase.org/life-with-cnm-mtm/the-disorder.php>
- Muscular Dystrophy Association  
<https://www.mda.org/disease/inherited-and-endocrine-myopathies/types/centronuclear-myotubular>
- Muscular Dystrophy UK: Congenital Myopathies  
<http://www.muscardystrophyuk.org/about-muscle-wasting-conditions/congenital-myopathies/>
- Myotubular Trust  
<http://www.myotubulartrust.com/>
- National Organization for Rare Disorders (NORD)  
<https://rarediseases.org/rare-diseases/x-linked-myotubular-myopathy/>
- University of Kansas Medical Center Resource List  
<http://www.kumc.edu/gec/support/muscular.html>

### GeneReviews

- X-Linked Centronuclear Myopathy  
<https://www.ncbi.nlm.nih.gov/books/NBK1432>

### ClinicalTrials.gov

- ClinicalTrials.gov  
<https://clinicaltrials.gov/ct2/results?cond=%22X-linked+myotubular+myopathy%22>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28x-linked+myotubular+myopathy%5BTIAB%5D%29+OR+%28x-linked+centronuclear+myopathy%5BTIAB%5D%29%29+AND+english%5BIa%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D>

### OMIM

- MYOPATHY, CENTRONUCLEAR, X-LINKED  
<http://omim.org/entry/310400>

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